REMARKS

Status of the Claims:

Claims 1 – 72 and 91 – 94 are pending.

Claims 1 – 20, 40 – 58, 71 and 72 are currently rejected.

Claims 21 – 39 and 59 – 70 are currently objected to.

Claims 10, 14, 41, 50, 54 and 73 – 90 are currently cancelled.

Claims 1, 2, 5 – 7, 9, 11 – 13, 15 – 26, 28 – 40, 42 – 49, 51 – 53 and 55 – 72 are currently amended.

Claims 91 – 94 are new claims

Amendments to the Claims:

No new matter has been introduced by way of the claim amendments.

Claims 21 and 32 have been rewritten in independent form, incorporating all the limitations of claim 1 as originally written. Further amendments to claims 21 and 32 are discussed hereinbelow. Additionally, claim 1 is presently amended from its original form to now include the limitations of claims 10 and 14.

Claims 59 and 66 have been rewritten in independent form, incorporating all the limitations of claim 40 as originally written. Further amendments to claims 59 and 66 are discussed hereinbelow. Additionally, claim 40 is presently amended from its original form to now include the limitations of claims 50 and 54.

As the claims presently stand amended, independent claims 1, 20, 32, 40, 59 and 66 are now pending in the application. In addition to the aforesaid amendments, certain dependent claims have been amended for the purposes of antecedent agreement, as necessitated by the amendments to the independent claims. Additional clarifying amendments to both the independent and dependent claims have also been made, as supported by the specification and

discussed hereinbelow. Applicants respectfully submit that the clarifying amendments are non-broadening. Specific comments concerning the claim amendments are set forth in the following paragraphs.

Amendments to Claims 1 – 20

Claim 1 now recites a method utilizing functionalized CNTs comprising oxidized, fluorinated carbon nanotubes, incorporating the limitations of claims 10 and 14. The description of the functionalized CNTs has been changed to 'oxidized, fluorinated CNTs' from 'functionalized CNTs with fluorine attached to their sidewalls and carboxylic acid groups attached to their ends' as originally recited in claim 14. As described in the specification in at least paragraphs [0018] and [0053], a carbon nanotube is 'oxidized to yield carboxylic acid groups on their ends, which are subsequently uncapped.' Applicants respectfully assert that the term 'oxidized, fluorinated CNTs' concisely describes the functionalized CNTs produced by the recited process. Support that the CNTs are oxidized and fluorinated may be found in the specification in at least paragraphs [0012], [0053], [0064], [0067], [0073] and [0074]. The oxidized, fluorinated CNTs are now described as 'comprising opened ends'. Support for this amendment may be found in the specification in at least paragraphs [0012], [0018], [0067] and [0082]. The process for forming the oxidized, fluorinated CNTs also now includes a limitation that the fluorinating step is conducted after the oxidizing step. Support for this amendment may be found in the specification in at least paragraphs [0018], [0053], [0068], [0072] and [0073]. The process for forming the oxidized, fluorinated CNTs also describes that the fluorinating step comprises attaching fluorine moieties to sidewalls of the oxidized CNTs. Support for this amendment may be found in claim 14 as originally filed and at least paragraphs [0018], [0053], [0064], [0072] and [0073] of the specification. Other amendments to claim 1 have been made for purposes of antecedent agreement.

Claim 2 is presently amended to change the verb to 'comprises' from 'involves'.

Claim 5 is presently amended for purposes of antecedent agreement. As amended, claim 5 recites that the mixing involves the 'dispersion and the epoxy resin', rather than the 'mixture components'.

Claim 6 is presently amended to recite that the mixing is 'conducted', rather than 'carried out'.

Claim 7 is presently amended for stylistic purposes.

Claim 9 is presently amended to clarify details of the mixing step, which was previously recited in the claim. Support for this amendment may be found in the specification in at least paragraphs [0052], [0069] and [0083].

Claim 11 is presently amended to recite that the unfunctionalized CNTs comprise SWNTs. Support for this amendment may be found in the specification in at least paragraphs [0063], [0064] and [0067].

Claim 12 is presently amended to clarify what the at least one enhanced property is measured relative to. Specifically, claim 12, as amended, describes a native epoxy as not comprising CNTs. Support for the amendments to claim 12 may be found in the specification in at least paragraphs [0043] and [0056].

Claim 13 is presently amended for antecedent agreement and to clarify that the enhanced load transfer is to the functionalized CNTs.

Claim 15 is presently amended to depend from claim 1, instead of now-cancelled claim 14. Claim 15 is also amended to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated Markush group.

Claim 16 is presently amended to depend from claim 1, instead of now-cancelled claim 14. Claim 16 is also amended to recite a step further comprising the process of claim 1. Claim 16 is also amended to recite that the purifying step takes place before the oxidizing step. Support for this amendment may be found in the specification in at least paragraphs [0046] and [0065].

Claim 17 is presently amended to depend from claim 1, instead of now-cancelled claim 14. Claim 17 is also amended to recite a step further comprising the process of claim 1. Claim 17 is also amended to clarify that the sorting step takes place before the oxidizing step. Support for these amendments may be found in the specification in at least paragraph [0046].

Claim 18 is presently amended to depend from claim 1, instead of now-cancelled claim 14. Claim 18 is also amended for purposes of antecedent agreement. Claim 18 is also amended to replace 'diamines' with 'at least one diamine'. Support for this amendment may be found in the specification in at least paragraphs [0018], [0019], [0047] and [0053]. The at least one diamine is described as comprising a first amino group and a second amino group. Claim 18 is further amended for purposes of clarity to recite that the step of reacting oxidized, fluorinated CNTs with at least one diamine forms 'oxidized, amino-functionalized CNTs', rather than 'amino-functionalized CNTs comprising amino groups attached to the CNT sidewalls' as previously written. Applicants respectfully assert that the term 'oxidized, amino-functionalized CNTs' more concisely describes the functionalized CNTs produced by the recited process. Support that the CNTs are oxidized and amino-functionalized may be found in the specification in at least paragraphs [0018] and [0053]. Further details concerning the oxidized, amino-functionalized CNTs are also included by way of describing the reaction between the at least one diamine and the oxidized, fluorinated CNTs. Support for the description of the reaction and the oxidized, amino-functionalized CNTs produced may be found in the specification in at least paragraphs [0018] and [0053].

Claim 19 is presently amended to depend from claim 1, instead of now-cancelled claim 14. Claim 19 is also amended for purposes of antecedent agreement. Claim 19 is also amended to clarify details concerning the integration process. Support for the amendments to claim 19 may be found in the specification in at least paragraphs [0018] and [0053].

Claim 20 is presently amended to depend from claim 18, instead of now-cancelled claim 14. Claim 20 is also amended for purposes of antecedent agreement. Claim 20 is also amended to clarify details concerning the integration process. Support that the at least one diamine comprises the curing agent may found in at least claims 14 and 20 as originally filed and in the specification in at least paragraphs [0016], [0018], [0053] and [0075].

Amendments to Claims 21 – 31

As discussed hereinabove, claim 21 has been rewritten in independent form to incorporate the limitations of claim 1 as originally written. As a result of rewriting claim 21 into independent form, amendments have been made for purposes of antecedent agreement. In

addition to the aforesaid amendments, details clarifying the process for making sidewall carboxylic acid-functionalized CNTs have been added. Applicants respectfully assert that the clarifying details are non-broadening.

Claim 22 is presently amended for antecedent agreement to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated Markush group.

Claim 23 is presently amended to recite a step further comprising the process of claim 21. Claim 23 is also amended for purposes of antecedent agreement. Claim 23 is amended to recite that the purifying step occurs before step a1 in claim 21. Support for this amendment may be found in the specification in at least paragraphs [0046], [0065] and [0082].

Claim 24 is amended to recite a step further comprising the process of claim 21. Claim 24 is also amended for purposes of antecedent agreement. Claim 24 is amended to clarify that the sorting step takes place before step a1 in claim 21. Support for these amendments may be found in the specification in at least paragraph [0046].

Claim 25 is amended to correct a grammatical error.

Claim 26 is presently amended for stylistic purposes.

Claim 28 is presently amended to include a description of the amino-functionalized CNTs produced in the method. The diamine is described as comprising a first amino group and a second amino group. The step of reacting the sidewall acyl chloride-functionalized CNTs with the diamine comprises bonding first amino groups comprising the diamine with the sidewall acyl chloride-functionalized CNTs to form amides. The amides are described as being terminated with second amino groups comprising the diamine. Support for these clarifying amendments may be found in at least Figure 10 and paragraphs [0019], [0082] and [0085] of the specification.

Claim 29 is presently amended for purposes of antecedent agreement. Claim 29 is also amended to clarify details concerning the integration process. Support for the clarifying amendments to claim 29 may be found claim 29 as originally filed and in at least paragraph [0075] of the specification.

Claim 30 is presently amended for purposes of antecedent agreement. Claim 30 is also amended to clarify details concerning the integration process. Claim 30 now describes that the curing agent comprises the diamine. Support for this amendment may be found in claim 30 as originally filed and in the specification in at least paragraphs [0018], [0054], [0081] and [0082]. Claim 30 also describes that the diamine comprises a first amino group and a second amino group. Integration is described as comprising a first reaction of first amino groups and a second reaction of second amino groups. Support for the clarifying amendments to claim 30 may be found in at least claim 30 as originally filed and in the specification in at least paragraphs [0018], [0043], [0054], [0081] and [0082].

Claim 31 is presently amended for purposes of antecedent agreement. Claim 31 is also amended to clarify details concerning the integration process. Support for the clarifying amendments to claim 31 may be found in at least claim 31 as originally filed and in the specification in at least paragraphs [0019], [0054], [0082] and [0083].

Amendments to Claims 32 – 39

As discussed hereinabove, claim 32 has been rewritten in independent form to incorporate the limitations of claim 1 as originally written. As a result of rewriting claim 32 into independent form, amendments have been made for purposes of antecedent agreement. In addition to the aforesaid amendments, details clarifying the process for making fluorinated, hydroxyl-functionalized CNTs have been added. Applicants respectfully assert that the clarifying details are non-broadening. Claim 32 is amended to recite that 'fluorinated, hydroxyl-functionalized CNTs' are formed by the process described in the claim, rather than 'hydroxyl-functionalized CNTs' as previously written. Applicants respectfully assert that the term 'fluorinated, hydroxyl-functionalized CNTs' more clearly describes the functionalized CNTs produced by the recited process. Support that the hydroxyl-functionalized CNTs are also fluorinated may be found in at least paragraph [0095] of the specification.

Claim 33 is presently amended for purposes of antecedent agreement.

Claim 34 is presently amended for purposes of antecedent agreement and to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated

Markush group.

Claim 35 is presently amended to recite a step further comprising the process of claim 32. Claim 35 is amended to recite that the purifying step occurs before step a1 in claim 32. Support for this amendment may be found in the specification in at least paragraphs [0046] and [0065].

Claim 36 is presently amended to recite a step further comprising the process of claim 32. Claim 36 is amended to clarify that the sorting step is performed on the unfunctionalized CNTs and that the sorting step takes place before step a1 in claim 32. Support for these amendments may be found in the specification in at least paragraph [0046].

Claim 37 is presently amended to change the verb to "comprises" from "is".

Claim 38 is presently amended for purposes of antecedent agreement and clarity. Claim 38 is amended to reference the metal hydroxide of claim 32. Claim 38 is further amended to clarify that Li, Na, and K refer to LiOH, NaOH and KOH. Support for these amendments may be found in the specification in at least paragraph [0095].

Claim 39 is presently amended for purposes of antecedent agreement. Claim 39 is also amended to clarify details concerning the integration process. Claim 39 recites that the curing agent comprises at least one amine. Support for this amendment may be found in at least claim 39 as originally filed and in at least paragraphs [0020], [0046] and [0055] of the specification. Claim 39 also recites that integration comprises a reaction between the at least one amine comprising the curing agent and epoxide groups comprising the fluorinated, epoxide-functionalized CNTs. Support for this clarifying amendment may be found in the specification in at least paragraphs [0020], [0047] and [0055].

Amendments to Claims 40 – 58

Claim 40 now recites a product-by-process utilizing functionalized CNTs comprising oxidized, fluorinated carbon nanotubes, incorporating the limitations of claims 50 and 54. The description of the functionalized CNTs has been changed to 'oxidized, fluorinated CNTs' from 'functionalized CNTs with fluorine attached to their sidewalls and carboxylic acid groups attached to their ends' as originally recited in claim 54. As described in the specification in at

least paragraphs [0018] and [0053], a carbon nanotube is 'oxidized to yield carboxylic acid groups on their ends, which are subsequently uncapped.' Applicants respectfully assert that the term 'oxidized, fluorinated CNTs' concisely describes the functionalized CNTs produced by the recited process. Support that the CNTs are oxidized and fluorinated may be found in the specification in at least paragraphs [0012], [0053], [0064], [0067], [0073] and [0074]. The oxidized, fluorinated CNTs are now described as 'comprising opened ends'. Support for this amendment may be found in the specification in at least paragraphs [0012], [0018], [0067] and [0082]. The process for forming the oxidized, fluorinated CNTs also now includes a limitation that the fluorinating step is conducted after the oxidizing step. Support for this amendment may be found in the specification in at least paragraphs [0018], [0053], [0068], [0072] and [0073]. The process for forming the oxidized, fluorinated CNTs also describes that the fluorinating step comprises attaching fluorine moieties to sidewalls of the oxidized CNTs. Support for this amendment may be found in at least claim 54 as originally filed and at least paragraphs [0018], [0053], [0064], [0072] and [0073] of the specification. Other amendments to claim 40 have been made for purposes of antecedent agreement.

Claim 42 is presently amended to change the verb to "comprises" from "involves".

Claim 45 is presently amended for purposes of antecedent agreement. Also as amended, claim 45 recites that the mixing involves the 'dispersion and the epoxy resin', rather than the 'mixture components'.

Claim 46 is presently amended to recite that the mixing is 'conducted', rather than 'carried out'.

Claim 47 is presently amended for stylistic purposes.

Claim 49 is presently amended to clarify details concerning the mixing step, which was previously recited in the claim. Support for this amendment may be found in the specification in at least paragraphs [0052], [0069] and [0083].

Claim 51 is presently amended to recite that the unfunctionalized CNTs comprise SWNTs. Support for this amendment may be found in the specification in at least paragraphs [0063], [0064] and [0067].

Claim 52 is presently amended to clarify what the at least one enhanced property is measured relative to. Specifically, claim 52, as amended, describes a native epoxy as not comprising CNTs. Support for the amendments to claim 52 may be found in the specification in at least paragraphs [0043] and [0056].

Claim 53 is presently amended for antecedent agreement and to clarify that the enhanced load transfer is to the functionalized CNTs.

Claim 55 is presently amended to depend from claim 40, instead of now-cancelled claim 54. Claim 55 is also amended to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated Markush group.

Claim 56 is presently amended to depend from claim 40, instead of now-cancelled claim 54. Claim 56 is also amended for purposes of antecedent agreement. Claim 56 is amended to recite a reaction between oxidized, fluorinated CNTs and at least one diamine to form oxidized, amino-functionalized CNTs. The at least one diamine is described as comprising a first amino group and a second amino group. Support for these amendments may be found in the specification in at least paragraphs [0018], [0019], [0047] and [0053]. Claim 56 is further amended for purposes of clarity to recite that the step of reacting oxidized, fluorinated CNTs with at least one diamine forms 'oxidized, amino-functionalized CNTs', rather than 'amino-functionalized CNTs comprising amino groups attached to the CNT sidewalls' as previously written. Applicants respectfully assert that the term 'oxidized, amino-functionalized CNTs' more concisely describes the functionalized CNTs produced by the recited process. Support that the CNTs are oxidized and amino-functionalized may be found in the specification in at least paragraphs [0018] and [0053]. Further details concerning the oxidized, amino-functionalized CNTs are also included by way of describing the reaction between the at least one diamine and the oxidized, fluorinated CNTs. Support for the description of the reaction and the oxidized, amino-functionalized CNTs produced may be found in the specification in at least paragraphs [0018] and [0053].

Claim 57 is presently amended to depend from claim 40, instead of now-cancelled claim 54. Claim 57 is also amended for purposes of antecedent agreement. Claim 57 is also amended to clarify details concerning the integration process. Support for the amendments to claim 57

may be found in the specification in at least paragraphs [0018] and [0053].

Claim 58 is presently amended to depend from claim 56, instead of now-cancelled claim 54. Claim 58 is also amended for purposes of antecedent agreement. Claim 58 is also amended to clarify details concerning the integration process. Support that the at least one diamine comprises the curing agent may be found in at least claims 54 and 58 as originally filed and in the specification in at least paragraphs [0016], [0018], [0053] and [0075]. The at least one diamine is described as comprising a first amino group and a second amino group. Support for a reaction of second amino groups with epoxide groups may be found in the specification in at least paragraphs [0018] and [0053].

Amendments to Claims 59 – 65

As discussed hereinabove, claim 59 has been rewritten in independent form to incorporate the limitations of claim 40 as originally written. As a result of rewriting claim 59 into independent form, amendments have been made for purposes of antecedent agreement. In addition to the aforesaid amendments, details clarifying the process for making sidewall carboxylic acid-functionalized CNTs have been added. Applicants respectfully assert that the clarifying details are non-broadening.

Claim 60 is presently amended for antecedent agreement to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated Markush group.

Claim 61 is presently amended for stylistic purposes.

Claim 62 is presently amended to include a description of the amino-functionalized CNTs produced by the process. The diamine is described as comprising a first amino group and a second amino group. The step of reacting the sidewall acyl chloride-functionalized CNTs with the diamine comprises bonding first amino groups comprising the diamine with the sidewall acyl chloride-functionalized CNTs to form amides. The amides are described as being terminated with second amino groups comprising the diamine. Support for these clarifying amendments may be found in at least Figure 10 and paragraphs [0019], [0082] and [0085] of the specification.

Claim 63 is presently amended for purposes of antecedent agreement. Claim 63 is also amended to clarify details concerning the integration process. Support for the clarifying amendments to claim 63 may be found in at least claim 29 as originally filed and at least paragraph [0075] of the specification.

Claim 64 is presently amended for purposes of antecedent agreement. Claim 64 is also amended to clarify details concerning the integration process. Claim 64 now describes that the curing agent comprises the diamine. Support for this amendment may be found in claim 64 as originally filed and in the specification in at least paragraphs [0018], [0054], [0081] and [0082]. Claim 64 also describes that the diamine comprises a first amino group and a second amino group. Integration is described as comprising a first reaction of first amino groups and a second reaction of second amino groups. Support for the clarifying amendments to claim 64 may be found in at least claim 64 as originally filed and in the specification in at least paragraphs [0018], [0043], [0054], [0081] and [0082].

Claim 65 is presently amended for purposes of antecedent agreement. Claim 65 is also amended to clarify details concerning the integration process. Support for the clarifying amendments to claim 65 may be found in at least claim 31 as originally filed and in the specification in at least paragraphs [0019], [0054], [0082] and [0083].

Amendments to Claims 66 – 72

As discussed hereinabove, claim 66 has been rewritten in independent form to incorporate the limitations of claim 40 as originally written. As a result of rewriting claim 32 into independent form, amendments have been made for purposes of antecedent agreement. In addition to the aforesaid amendments, details clarifying the process for making fluorinated, hydroxyl-functionalized CNTs have been added. Applicants respectfully assert that the clarifying details are non-broadening. Claim 66 is amended to recite that 'fluorinated, hydroxyl-functionalized CNTs' are formed by the process described in the claim, rather than 'hydroxyl-functionalized CNTs' as previously written. Applicants respectfully assert that the term 'fluorinated, hydroxyl-functionalized CNTs' more clearly describes the functionalized CNTs produced by the recited process. Support that the hydroxyl-functionalized CNTs are also fluorinated may be found in at least paragraph [0095] of the specification.

Claim 67 is presently amended for purposes of antecedent agreement.

Claim 68 is presently amended for purposes of antecedent agreement and to recite that the unfunctionalized CNTs comprise a carbon nanotube type selected from the indicated Markush group.

Claim 69 is presently amended to change the verb to 'comprises' from 'is'.

Claim 70 is presently amended for purposes of antecedent agreement. Claim 70 is also amended to clarify details concerning the integration process. Claim 70 recites that the curing agent comprises at least one amine. Support for this amendment may be found in at least claim 70 as originally filed and in at least paragraphs [0020], [0046] and [0055] of the specification. Claim 39 also recites that integration comprises a reaction between the at least one amine comprising the curing agent and epoxide groups comprising the fluorinated, epoxide-functionalized CNTs. Support for this clarifying amendment may be found in the specification in at least paragraphs [0020], [0047] and [0055].

New Claims:

Claims 91 – 94 are new claims paralleling the elements recited in claims 71 and 72. Claims 91 and 92 reference independent claim 59. Claims 93 and 94 reference independent claim 66. Support for the new claims may be found in at least original claims 71 and 72 and paragraphs [0047], [0056] and [0059] of the specification.

I. Response to Previous Restriction Requirement

Applicants previously elected claims 1 – 72 (drawn to a CNT-epoxy polymer composite and a method of making the same) without traverse in a response of record filed August 13, 2008. Office Action item 1. Applicants hereby cancel claims 73 – 90 drawn to the non-elected invention. Applicants reserve rights to file one or more divisional applications on the non-elected invention at Applicants' discretion at a later date.

II. Claim Rejections Under 35 U.S.C. § 103

Claim Rejections

Claims 1 – 9, 12, 13, 40 – 49, 52, 53, 71 and 72 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Sandler, *et al.*, "Development of a dispersion process for carbon nanotubes in an epoxy matrix and the resulting electrical properties," *Polymer*, 40:1999, pp. 5967-5971 (hereinafter, *Sandler*) in view of WO 02/060812 (hereinafter, *Tour*). Office Action item 4. Applicants respectfully traverse the rejection of these claims.

Claims 10, 11, 50 and 51 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of *Sandler* and *Tour* in view of Stevens, *et al.*, "Sidewall Amino-Functionalization of Single-Walled Carbon Nanotubes through Fluorination and Subsequent Reactions with Terminal Diamines", *Nano Lett.*, 3:2003, pp. 331-336 (hereinafter, *Stevens*). Office Action item 5. Applicants respectfully traverse the rejection of these claims.

Claims 14 – 20 and 54 – 58 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of *Sandler* and *Tour* in view of *Stevens* and Chiang, *et al.*, "Purification and Characterization of Single-Wall Carbon Nanotubes", *J. Phys. Chem.* B, 105:2001, pp. 1157-1161. Office Action item 6. Applicants respectfully traverse the rejection of these claims.

Assertions by the Examiner

The Examiner asserts that the elements of claims 1 – 9, 12, 13, 40 – 49, 52, 53, 71 and 72 are taught by *Sandler* in view of *Tour*. Office Action item 4, pages 2 – 5. The Examiner asserts that although *Sandler* does not teach functionalized CNTs, *Tour* teaches functionalized CNTs that are compatible with a polymer matrix. The Examiner therefore asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the functionalized CNTs of *Tour* in the process of *Sandler* and to use fiber reinforcements in the process taught by *Sandler*.

Regarding claims 10, 11, 50 and 51, the Examiner asserts that *Sandler* and *Tour* do not teach the functional groups set forth in these claims (specifically fluorinated CNTs). Office Action item 5, pages 5 – 6. The Examiner asserts that *Stevens* teaches fluoro-CNTs prepared by

direct fluorination of purified SWNTs. Therefore, the Examiner asserts that it would have obvious to one of ordinary skill in the art at the time of the invention to utilize the CNTs taught by *Stevens* in the combined teachings of *Sandler* and *Tour*.

Regarding claims 14 – 20 and 54 – 58, the Examiner asserts that *Stevens* does not explicitly teach the presence of carboxylic acids at the ends of the [fluoro]-CNTs. Office Action item 6, pages 6 – 7. The Examiner asserts that *Chiang* teaches purification of CNTs by methods including acid oxidation, which produces carboxylic acid groups at the tube ends of the CNTs. The Examiner asserts that the acid oxidation is an obvious purification technique that could be applied prior to the functionalization taught by *Stevens* to yield the dual functionality set forth in these claims. Therefore, the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the combined teachings of *Chiang* and *Stevens* and the combined teachings of *Sandler* and *Tour*.

Response by Applicants

Independent Claim 1

As previously set forth in the amendments to the claims, independent claim 1 is presently amended to include the limitations previously recited in claims 10 and 14. Since independent claim 1 is presently amended to include the limitations previously recited in claims 10 and 14, Applicants respectfully assert that the patentability of this claim, as amended, rests upon non-obviousness over the combined teachings of *Chiang* and *Stevens* as applied to the combined teachings of *Sandler* and *Tour* (see Office Action, items 4 – 6).

Applicants' reading of *Chiang* and *Stevens* follows. *Stevens* teaches reactions of fluorinated SWNTs with terminal diamines to form C-N functionalized SWNTs by displacing the fluorines (*Stevens*, abstract). The fluorinated SWNTs are prepared from purified HiPco SWNTs (*Stevens*, p. 331, last paragraph). There is no teaching or suggestion in *Stevens* that either the purified SWNTs or fluorinated SWNTs contain carboxylic acid groups. For example, the ATR-FTIR spectrum of fluorinated SWNTs presented in Figure 3 of *Stevens* does not indicate a broad O-H stretch indicative of the presence of carboxylic acid groups. Although the primary focus of *Chiang* is purification of SWNTs by heating in air, *Chiang* does teach four

major methods that are known for purifying SWNTs, including acid oxidation (*Chiang*, abstract and p. 1157, paragraph 3). *Chiang* teaches that acid oxidation produces carboxylic acid groups at the tube ends. There is no teaching or suggestion in *Chiang* that air oxidation or any of the other purification methods produce carboxylic acid groups at the tube ends. Thus, the four purification methods taught by *Chiang* are non-equivalent in scope.

Applicants have amended claim 1 to recite a method utilizing oxidized, fluorinated CNTs for preparing CNT-epoxy composites. Applicants respectfully assert that the oxidized, fluorinated CNTs recited in claim 1 are not taught or suggested by either *Chiang* or *Stevens*, either separately or in combination. The oxidized, fluorinated CNTs of claim 1 are produced by a process comprising: a1) oxidizing unfunctionalized CNTs to form oxidized CNTs having opened ends, and a2) fluorinating the oxidized CNTs to form oxidized, fluorinated CNTs. The opened ends comprise carboxylic acid groups. As recited in claim 1 and supported in the specification, the fluorinating step takes place after the oxidizing step. Applicants respectfully assert that neither *Chiang* nor any of the other cited references teach or suggest a reaction of oxidized carbon nanotubes with fluorine (step a2). Although *Stevens* teaches fluorination of purified HiPco SWNTs, as discussed hereinabove, it is clear from Figure 3 of *Stevens* that the fluorinated SWNTs of *Stevens* do not contain carboxylic acid groups. Hence, *Stevens* does not teach or suggest fluorination of an oxidized carbon nanotube.

The Examiner asserts that applying the acid oxidation taught by *Chiang* prior to the fluorination taught by *Stevens* would be obvious. Office Action item 6. As the purification methods taught by *Chiang* are clearly non-equivalent in scope, Applicants respectfully assert that there is neither sufficient motivation nor a reasonable expectation of success to combine the acid oxidation taught by *Chiang* with the fluorination taught by *Stevens* to arrive at Applicants' claimed method utilizing oxidized, fluorinated CNTs.

> "A rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art." MPEP 2143.02. Although "[obviousness] does not require absolute predictability…at least some degree of predictability is required." *Ibid.*

Applicants respectfully assert that fluorination step a2) in Applicants' claimed process for making CNT-epoxy composites fails to meet the above criteria for establishing *prima facie* obviousness. The cited references do not teach or suggest a reaction of oxidized carbon nanotubes with fluorine. Hence, combining *Chiang* and *Stevens* does not meet the required criteria for predictability, since one of ordinary skill in the art would recognize that reactions of elemental fluorine are highly unpredictable. As such, one of ordinary skill in the art would recognize that non-routine experimentation would be required to achieve successful, controlled fluorination of an oxidized carbon nanotube. *Chiang* alludes to the fact that functionalized carbon nanotubes have different reactivity. *Chiang* specifically states that "[since] functionalized SWNTs will have considerably different properties than those of pristine tubes, the extent of chemical modification achieved through the acid purification route must be carefully evaluated." (*Chiang,* p. 1157, paragraph 3, emphasis added). An oxidized carbon nanotube is a type of functionalized carbon nanotube. In view of the different properties of functionalized carbon nanotubes referenced by *Chiang*, fluorination of oxidized carbon nanotubes is rendered non-obvious. Hence, Applicants' claim 1 utilizing oxidized, fluorinated CNTs to form a CNT-epoxy composite is rendered non-obvious.

In view of the foregoing remarks, Applicants respectfully assert that the cited references do not teach or suggest all the limitations of claim 1, either singularly or in combination. For rejections under 35 U.S.C. § 103(a), all claim limitations must be taught or suggested by the prior art to establish obviousness. *In re Royka,* 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). Therefore, Applicants respectfully assert that independent claim 1 is allowable. Claims 2 – 9, 11 – 13 and 15 – 20 depend either directly or indirectly from independent claim 1 and are patentable for at least the same reasons. *In re Fine,* 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). Therefore, withdrawal of the Examiner's rejections of claims 1 – 20 under 35 U.S.C § 103(a) is respectfully requested in view of the foregoing remarks and amendments.

Independent Claim 40

As previously set forth in the amendments to the claims, independent claim 40 is presently amended to include the limitations previously recited in claims 50 and 54. Since independent claim 40 is presently amended to include the limitations previously recited in claims

50 and 54, Applicants respectfully assert that the patentability of this claim rests upon non-obviousness over the combined teachings of *Chiang* and *Stevens* as applied to the combined teachings of *Sandler* and *Tour* (see Office Action, items 4 – 6).

Applicants' claim 40 recites a product-by-process CNT-epoxy polymer composite, wherein the CNTs comprising the composite are functionalized CNTs. The functionalized CNTs are oxidized, fluorinated CNTs prepared by a process comprising steps: a1) oxidizing unfunctionalized CNTs to form oxidized CNTs having opened ends, and a2) fluorinating the oxidized CNTs to form oxidized, fluorinated CNTs. The opened ends comprise carboxylic acid groups. As recited in claim 40, the fluorinating step takes place after the oxidizing step. Applicants respectfully assert that the cited references do not teach or suggest a reaction of oxidized carbon nanotubes with fluorine, either separately or in combination. Applicants' comments presented hereinabove regarding the non-obviousness of oxidized, fluorinated CNTs are hereby incorporated by reference. Therefore, the cited references do not teach or suggest the oxidized, fluorinated CNTs recited in claim 40.

Since the cited references do not teach or suggest oxidized, fluorinated CNTs, Applicants respectfully assert that the CNT-epoxy polymer composite of claim 40 comprising oxidized, fluorinated CNTs is also not taught or suggested by the cited references. Therefore, Applicants respectfully assert that independent claim 40 describes a patentably distinct CNT-epoxy polymer composite and is allowable. Claims 42 – 49, 51 – 53, 55 – 58, 71 and 72 depend either directly or indirectly from independent claim 40 and are patentable for at least the same reasons. Therefore, withdrawal of the Examiner's rejections of claims 40 – 58, 71 and 72 under 35 U.S.C § 103(a) is respectfully requested in view of the foregoing remarks and amendments.

III. Claim Rejections Under 35 U.S.C. § 102/103

Claims 40 – 49, 52, 53, and 71 stand rejected under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) obvious over *Tour*. Office Action item 8. Applicants respectfully traverse the rejection of these claims.

The Examiner asserts that *Tour* teaches CNT-epoxy polymer composites similar to the instant claims, but *Tour* fails to disclose the process steps. The Examiner asserts that the CNT-

epoxy polymer composites taught by *Tour* inherently or obviously satisfy the instantly claimed product-by-process material since the CNT-epoxy polymer composites of *Tour* satisfy all of the material and chemical limitations of the instant claims.

As discussed hereinabove, Applicants have amended claim 40 to recite a product-by-process utilizing functionalized CNTs. The functionalized CNTs are oxidized, fluorinated CNTs prepared by a process comprising the following steps: a1) oxidizing unfunctionalized CNTs to form oxidized CNTs, and a2) fluorinating the oxidized CNTs to form oxidized, fluorinated CNTs. The oxidized, fluorinated CNTs have opened ends comprising carboxylic acid groups. The fluorinating step is conducted after the oxidizing step.

Tour teaches CNT-epoxy polymer composites in which the CNTs are functionalized by a diazonium species. Applicants respectfully assert that *Tour* does not teach, either expressly or inherently, or suggest CNTs that are both oxidized and fluorinated. There is no teaching or suggestion in *Tour* regarding preparation of CNT-epoxy polymer composites, other than those prepared from CNTs functionalized using a diazonium species. Therefore, the CNT-epoxy polymer composites taught by *Tour* and the product-by-process CNT-epoxy polymer composite of claim 40 are at least distinguished by the differences between the CNTs utilized in each composite material. Applicants further reiterate their remarks concerning non-obviousness of oxidizing and then fluorinating CNTs, which are presented hereinabove and incorporated herein by reference.

An anticipation rejection under 35 U.S.C. § 102 requires each claim element to be present in the cited art either expressly or inherently. M.P.E.P. § 2131, *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). For rejections under 35 U.S.C. § 103(a), all claim limitations must be taught or suggested by the prior art to establish obviousness. *In re Royka,* 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). Since *Tour* does not teach, either expressly or inherently, or suggest the oxidized, fluorinated CNTs of claim 40, Applicants respectfully assert that claim 40 is patentable over *Tour* under both 35 U.S.C. § 102(a) and 103(a). Claims 42 – 49, 51 – 53, 55 – 58, 71 and 72 depend either directly or indirectly from independent claim 40 and are patentable for at least the same reasons. Therefore, withdrawal of the Examiner's rejections of claims 42 – 49, 52, 53 and 71 under 35 U.S.C §

102(a) or, in the alternative, under 35 U.S.C § 103(a) is respectfully requested in view of the foregoing remarks and amendments.

IV. Provisional Double Patenting Rejections

Claims 40 – 49, 52, 53, 71 and 72 are provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 16 – 22 of co-pending Application No. 11/632,196 (US2008/0048364; hereinafter, the '364 application). The Examiner asserts that the instant claims and claims 16 – 22 of the referenced application are not patentably distinct from each other. Office Action item 10. Applicants respectfully traverse the Examiner's provisional rejection of these claims.

Claims 40 – 49, 52, 53, 71 and 72 are provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 54 – 68 of co-pending Application No. 10/561,712 (US2007/0259994; hereinafter, the '994 application). The Examiner asserts that the instant claims and claims 54 – 68 of the referenced application are not patentably distinct from each other. Office Action item 11. Applicants respectfully traverse the Examiner's provisional rejection of these claims.

Claims 16 – 22 of the '364 application recite a B-stage powder comprising CNTs, polymer material, and at least one unactivated curing agent. Claims 40 – 49, 52, 53, 71 and 72 recite a CNT-epoxy polymer composite having functionalized CNTs, wherein the functionalized CNTs are oxidized, fluorinated CNTs. Since the claims of the '364 application do not recite oxidized, fluorinated CNTs as a claim element, Applicants respectfully assert that claims 40 – 49, 52, 53, 71 and 72, as they presently stand amended, are patentably distinct from claims 16 – 22 of the '364 application.

Claims 54 – 68 of the '994 application recite a CNT-elastomer composite comprising functionalized CNTs in an elastomeric matrix. Claims 40 – 49, 52, 53, 71 and 72 recite a CNT-epoxy polymer composite having functionalized CNTs, wherein the functionalized CNTs are oxidized, fluorinated CNTs. Since the claims of the '994 application do not recite oxidized, fluorinated CNTs as a claim element, Applicants respectfully assert that claims 40 – 49, 52, 53, 71 and 72, as they presently stand amended, are patentably distinct from claims 16 – 22 of the

'364 application.

Applicants respectfully assert that claims 40 – 49, 52, 53, 71 and 72, as presently amended, are patentably distinct over the claims of the '364 and '994 applications. Therefore, Applicants respectfully request that the Examiner's provisional rejection of these claims be withdrawn. Further, Applicants note that if the provisional double patenting rejection is the only rejection remaining in one of the applications (but not both), the Examiner should withdraw the rejection and permit that application to issue as a patent. MPEP § 804.I.2. At that time, the provisional double patenting rejection in the second application should be converted into a double patenting rejection.

V. Allowable Subject Matter

The Examiner has objected to claims 21 – 39 and 59 – 70 for being dependent upon a rejected base claim. However, the Examiner has stated that these claims would be allowable if written in independent form including all the limitations of the base claim and any intervening claims. Office Action item 12.

Applicants have rewritten claims 21 and 32 in independent form. The amended claims include all the limitations of the method of claim 1, as originally written. Applicants respectfully assert that the amendments to claims 21 and 32 are non-broadening, and the amended claims describe methods that remain allowable.

Applicants have rewritten claims 59 and 66 in independent form. The amended claims include all the limitations of the product-by-process of claim 40, as originally written. Applicants respectfully assert that the amendments to claims 59 and 66 are non-broadening, and the amended claims describe product-by-process CNT-epoxy polymer composites that remain allowable.

VI. New Claims

Claims 91 – 94 are new claims paralleling the elements recited in claims 71 and 72. Claims 71 and 72 originally referenced the CNT-epoxy polymer composite prepared by the process of claim 40. With the narrowing amendments made to claim 40 and the rewriting of

claims 59 and 66 in independent form, new claims 91 – 94 are necessary to describe patentable subject matter relating to the CNT-epoxy polymer composites prepared by the process of claims 59 and 66. Claims 91 and 92 depend from independent claim 59. Claims 93 and 94 depend from independent claim 66. Applicants respectfully assert that since claims 91 – 94 depend from claims that are now allowable, claims 91 – 94 are allowable as well.

VII. Objection to the Drawings

The Examiner has objected to the drawings for failing to comply with 37 CFR 1.84(p)(5) because they do not include reference signs mentioned in the written description. Specifically, the Examiner has noted that reference signs **1801** and **1803** do not appear in Figure 18. Office Action item 14.

Applicants submit a complete listing of amended drawing sheets pursuant to 37 CFR 1.121(d) with this response. The amended drawings provide proper inclusion of reference signs **1801** and **1803** in Figure 18. No new matter has been introduced by way of the amended drawing sheets.

CONCLUSIONS

Claims 1 – 9, 11 – 13, 15 – 40, 42 – 49, 51 – 53, 55 – 72 and 91 – 94 remain pending in the application. Applicants respectfully assert that Claims 1 – 9, 11 – 13, 15 – 40, 42 – 49, 51 – 53, 55 – 72 and 91 – 94, as they presently stand amended, are patentably distinct over the cited references and are in a condition for allowance.

If additional fees are due and are not included, the Director is hereby authorized to charge any fees or credit any overpayment to Deposit Account No. 23-2426 of Winstead PC (referencing matter 11321-P066WOUS). If the Examiner has any questions or comments concerning this paper or the present application in general, the Examiner is invited to call the undersigned at (713) 650-2780.

Respectfully submitted,

WINSTEAD PC

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Date: February 19, 2009

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